

Multiple representations thematic and spatial reading-level and higher-level question: An experience in basic education in Brazil

Bruno Zucherato*, Maria Isabel Castreghini de Freitas**

* PPGG - Post Graduate Program in Geography/UNESP - State University of São Paulo - Rio Claro, Brazil

** Geosciences and Exact Science Institute/UNESP - State University of São Paulo - Rio Claro, Brazil

Abstract. The representation area in thematic cartography has as one of its methods the graphic sociology, which rests on the system of signs and meanings guided by the reading of the space at different levels of analysis, as the level of the question and the reading level. These levels can be applied to different methods of spatial representations. The reading space in the question level allows the reader of the representation establish the reading of the geographic space presented in two forms: the level of detail question and the level of global question. The first allows answers to questions such as "what place? what's there?", while the second allows answer for the question "in what place is this data value?". The reading space on the upper level requires the reader a spatial analysis, in what should be done a correlation between different thematic values presented by representation in different localities.

With the purpose of observing these different levels of spatial reading using different representations, this work presents the results of a practice held in a public school located in the county of Santa Gertrudes (State of São Paulo), with sixty-one students of the 3rd year of high school, aged 17 years. The practice held sought to establish how students interact with the reading of a geographic space represented by multiple representations graphics and cartographics – column charts, anamorphosis maps, coropleth maps – and also establish what levels of question reading and of upper reading were performed by these students in their interaction with the representations used. The content used in practice has consisted of developing multiple spatial representations (column charts, anamorphosis maps, coropleth maps) of the same geographic theme proposed by the teacher: the indigenous population of Latin America. First these representations were presented to students and, then were asked questions related to the topic presented. This

exercise required the students to do a reading of question level and upper level. In the activity the students should indicate which representation was used to answer each question.

The results of this practice showed that 65% of students used only one representation to answer the exercises, while the remaining 35% used multiple representations. Among the students who used the multiple representations, the practice has disclosed that 65% of them answered correctly the exercise that required the level of global question, while 82% of students answered correctly the exercises that required a reading level of detail question and an upper reading of the presented informations. These results show that most students who participated in the practice performed did not use multiple representations, and among students who used multiple representations, the reading level of the global question was the one in which students had more reading difficulty.

We can conclude that it is extremely important the encouragement of the use of multiple representations since the Elementary School, in order that students can to develop better this level of reading, what may provide a better reading of geographical space.

Considering that each type of representation values a certain level of reading space disadvantaging another one, the teacher should indicate to students what types of representations are more suitable in every context.

Keywords: Multiple representations, Reading Space, Basic education

1. Introduction

Cartography is currently a science extremely important for the studies related to Geography. Its importance is firm in both theoretical and practice camp, working in several areas of knowledge, and forming an spatial language used for both technical works and as a recourse to scholar teaching on geography.

The application of geography meets different forms of investigation that are based on various scientific methodologies. Understanding these different methodologies helps to investigate how we assimilate and understand spatialized information, then becoming very important as we treat of teaching and, more specifically, of Cartography teaching as a way to spatialize geographic information.

Among different theoretical and methodological references of science, we highlight Graphic Semiology as an important contribution to understanding of apprehension processes of spatial information. This theory of carto-

graphic analysis has some elements, such as spatial reading in question level and reading in higher question.

In the case of this present paper, it was performed a practice with the students of a high school and, during the realization of this practice, the students were given different representations for they read and answer an questionnaire. The answers enabled to infer what the reading level (in level of question or in higher level) of these students is.

2. Graphic Semiology

The study of semiology is based on researchs carried out by Ferdinand Saussure, which involved the usage of the signs within social life's breast (Matias, 1996), being initially used to understand Bertin's cartographic representations (1965), in an attempt to organize and structure theoretical and methodological aspects on which the studies on Cartography should be based.

For semiology, the comprehension of society's signs uses mainly two channels of communication or perception: auditory and visual. The study of spatial representations directly leans on visual perception of graphic representation.

The graphic representation can be considered a system of signs men built to understand and to communicate the observations are necessary to them, through a language aimed to the eyes, thus using visual perception (Bertin, 1965).

For theoreticians of this line, language can be classified into three types: pansemic, polissemic and monosemic language. Cartographic lineage, on the other hand, is considered monosemic (Loch, 2006).

Monosemic systems are those in which knowledge of the meaning of a sign precedes its observation (Bertin, 1965). This way, the meaning attributed to this sign is singular, not accepting ambiguity. For example, a map cannot be understood before one knows the signs used in its representation and pointed at the label.

Pansemic systems are those in which the meanings attributed to a sign cannot be determinated precisely, being liable to a subjective interpretation, as in the case of music, in ear canal, or of a non-figurative image, in visual canal. Yet the polisemic systems are those in which the meaning succeeds the sign's observation (Bertin, 1965), therefore being questionable systems, to which we can attribute different meanings. Qhen we observe a drawing, we

can attribute different meanings to it, as it's considered a sample of polisemic system.

According to the theory of graphic semiology, the representations, when observed and understood, have a level of information transmission variable, that can be from a reading in general to a more specific reading of presented information. These different levels of comprehension were organized by Bonin (1975) and they are known as Level of Question and Level of Reading.

2.1. Information in level of question

Information in level of question deals with the spatial apprehension where articulations between information's view and brain allow to extract from the representation not a reading, but only the obtainment of answers to questions on graphic representation into two orders: Level of question of detail and Level of global question.

In Level of question of detail, presented information enables its observer to answers specific questions of determined localities, articulating the spatial unity with its respective thematic value.

In this case, mental articulation determines a specific point at the map, recognizes this point, and decodes the representation of this point in the classes presented by the label. Extracted information in this level refers to answers, for example to the following question: "In such place, what is there within it?" (Bonin, 1975). Mental operation goes from map observation to label observation.

In Level of global question, the obtainment of answers on spatial information processes inversely to Level of question of detail. The Level of global question enables its observer to establish a general view of presented information, focusing not specific spatial unities, but presented thematic values. In this case, mental operation starts from label, going to graphic representation.

In this level, the type of question to which one has the answers, noting the spatial representation, refers to "In which place is such value? (Bonin, 1975). It starts then from a specific thematic value to know the locality where this value can be found in graphic representation.

2.2. Information in reading-Level

Information in reading-Level, differently from information in Level of question, enables not only to elaborate and to answer presented questions in a graphic representation, but also to read presented information (Bonin, 1975). In this case, spatial reading requires spatiality's knowledge of pre-

sented information, being this reading realized by two forms: Level of elementary reading and level of higher reading.

The Level of elementary reading consists in simple recognition of different localities of a graphic representation – this elementary reading does not enable to extract or to comprehend more complex spatial information; what's only possible in Level of higher reading.

In Level of higher reading, the reader performs a mental operation enables him to recognize different presented localities and different thematic values, establishing a spatial correlation (1975). Thereby, for higher reading to occur, the representation's observer must recognizes different geographic localities and its correspondent values at the label, obtaining a spatial analysis of information.

Frame 1 presents a synthesis with a structuration and characteristics of different levels of question and reading:

General Levels	Specific levels	Characteristic
Level of Question	Level of question of detail	"In such place what, is there in it?"
	Level of global question	"In which place is this value?"
Level of Reading	Level of elementary reading	Elementary reading of information
	Level of higher reading	Correlation and spatial analysis

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3. Practice performed in school

In order to verify the capacity of spatial reading in level of question and reading of students in school age, it was performed a practice activity with 61 students that attend 3rd Year of High School (last scholar year), average aged in 17 years old, in State School Pedro Raphael da Rocha, in Santa Gertrudes city, São Paulo State, Brazil.

The practice activity was performed with two classes in doubles classes of the course of Geography, being 30 students from a class, and 31 from the other.

The practice performed aimed to establish how students interact with the reading of a geographic space represented by multiple graphic representations: column charts, anamorphic and choropleth maps, and yet to establish what Levels of higher reading, of question of detail and global question performed by these students during the interaction with presented representations.

This way, individually, they were given to the students a sheet of paper, three different representations (a column chart, a choropleth map and an anamorphic map presenting the following theme: The indigenous population in Latin American countries). Along with these representations, the student was requested to answer several exercises indicating which representation he was using to obtain the answers. Altogether, each student should answer 4 exercises structured as follows:

In the first exercise, the students should answer, based on one of given representations, the following question: "Find on the map the five countries with higher indigenous presence in total population. How does geographic localization of these countries explain these data?" This question was extracted from a schoolbook and composed the practice activity as a condition made by the regular teacher.

In the second exercise, the students should answer the following question: "Point a country has indigenous population over 4 million "; the answer to this question required from students the Level of global question;

In the third exercise, the question put to students was: "What's the approximate Ecuadorian indigenous population?"; the answer to this exercise required comprehension of graphic representation and level of question of detail;

The last and fourth exercise presented the following question: "Make a relation between Bolivian and Paraguayan indigenous population"; the answer to this exercise required the student to perform an observation of representation of level of higher reading, once it required a spatial analysis of information.

This way, from correct and wrong answers obtained from student in each exercise, it's possible to determine how they perform spatial reading by multiple representations, and what's the comprehension these students have regarding level of global question and of detail, and the level of higher reading.

Moreover, students should indicate which representation they used to answer the exercises, in order to comprehend how and how much they used the multiple representations.

4. Obtained Results

Results obtained from the practice showed that, from 61 students, 64% (34 students) from the total that attended the practice used only one representation to answer proposed exercises, while 30% (19 students) used two representations and 6% (3 students) used all three representations. These values evidenced students are not used to interpret multiple representations.

About more specific results regarding comprehension of levels of global question and of detail, and of level of higher reading, results showed that, from 61 students attended the practice, 65% (40 students) answered correctly exercise 2, which required Level of global question, as 35% (21 students) didn't answer the exercise correctly.

Regarding the comprehension of graphic representation in level of question of detail, which referred to exercise 4, the practice's results showed that 82% (50 students) answered it correctly, as 18% (11 students) answered it incorrectly.

About the level of higher reading, required in exercise 4, the practice also showed 82% (50 students) answered the question correctly, as 18% (11 students) didn't answer it correctly.

These values can be better observed in the following chart (figure 1).

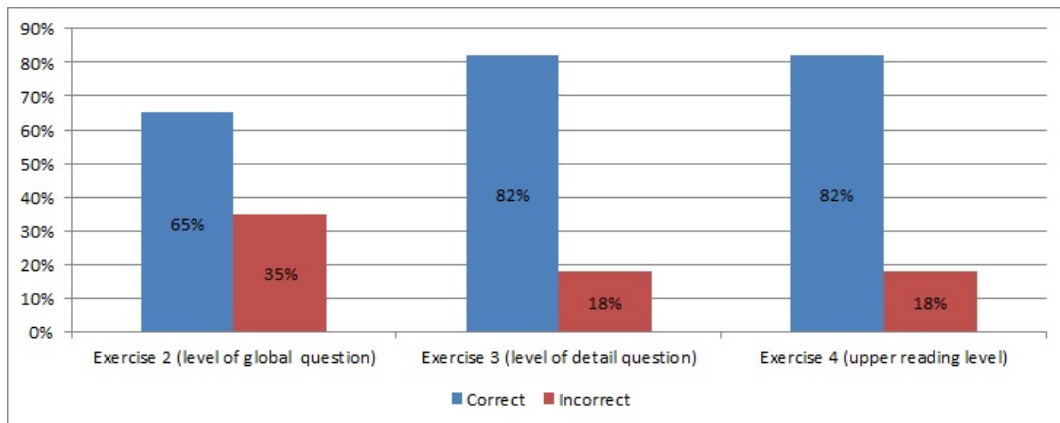


Figure 1. Chart presenting results organized in practice percentages.

Based on these results, it's clear that students attended the practice find it difficult to interpret the graphic representation in level of global question, presenting better ability in level of question of detail and also in level of higher reading.

From this result, the teacher can restructure his strategies and methodologies of teaching geography and cartography, emphasizing the development of this ability in the students, correcting then this deficiency regarding spatial reading, pursuing a better educational formation in reading and spatial analysis.

References

- Bertin J (1965) *Semiologie graphique: les diagrammes – les réseaux – les cartes*. Gauthier-Villars;
- Bonin S (1975) *Initiation a la graphique*. Epi S.A;
- Loch REN (2006) *Cartografia: Representação, comunicação e visualização de dados espaciais*. Publishing House of Santa Catarina Federal University (UFSC);
- Matias LF (1996) *Por uma cartografia geográfica*. Thesis (master thesis), São Paulo University (USP) – Faculty of Philosophy, Literature and humanities.